



# Welcome

Delaware River Main Channel Deepening  
Industry Day Event  
February 25, 2011

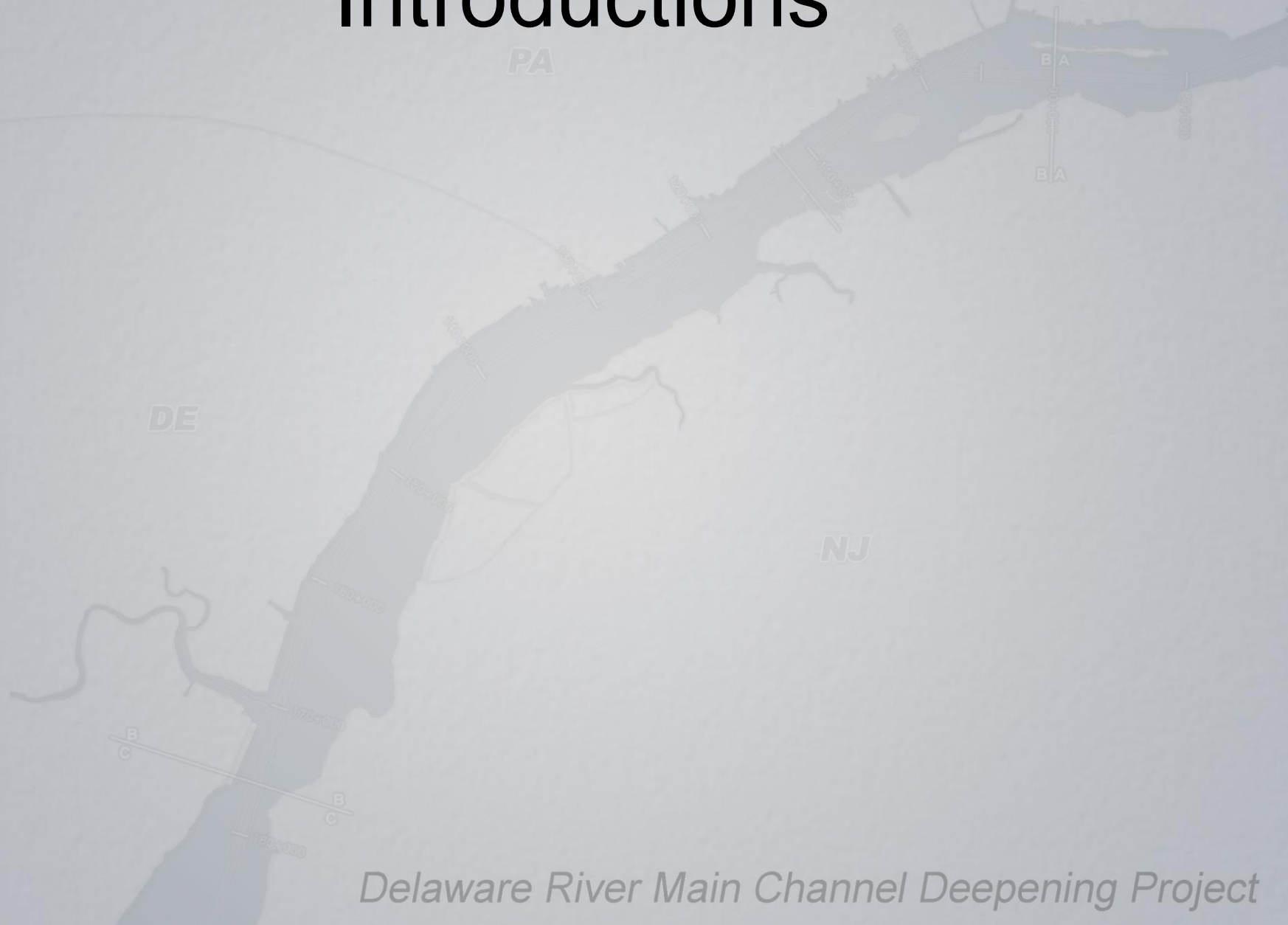
U.S. Army Corps of Engineers  
Philadelphia District

Philadelphia Regional Port Authority

*Delaware River Main Channel Deepening Project*



# Introductions



*Delaware River Main Channel Deepening Project*



# Meeting Purpose

- Seek dredging industry input regarding best practices for technical execution of rock removal portion of the DRMCD project.



# Presentations

- Project Overview
- Dredging, Transport and Placement
- Dredging/Blasting Restrictions
- Geotechnical Data & Reports
- Contract Types



# Meeting Protocol

- Questions/Suggestions
  - Please ask questions or make suggestions at any time!
  - Request that all questions/suggestions are on topic and pertain to material being presented.
  - Please raise your hand.



# Project Overview

- Deepen channel from 40 to 45 feet MLLW from Philadelphia to mouth of Delaware Bay – approx. 102.5 miles
- Existing channel widths unchanged
- 12 of existing 16 bends will be widened



# Project Overview (cont.)

- Marcus Hook Anchorage deepened to 45 feet
- Non-Federal sponsor – Philadelphia Regional Port Authority (PRPA)





# Project Overview (cont.)

- Dredged Material Disposal
  - Existing Federal upland CDFs in New Jersey, Delaware, and Pennsylvania (rock)
  - Kelly Island, DE (wetland restoration)
  - Broadkill Beach, DE (shore protection)





# Project Overview (cont.)

- Bulk of dredging performed by hopper and cutter suction dredges
- Blasting/mechanical dredge used for rock removal
- Project divided into 6 reaches – AA, A, B, C, D, and E





# Project Overview (cont.)

- Reach C completed September 2010
- Next contract – lower section of Reach B (Sta. 155+000 to Sta. 176+000) – Summer 2011
- Remaining contracts over next 5+ years



# Project Overview (cont.)

- Rock contract next year – 2012
- Construction schedule subject to available funding



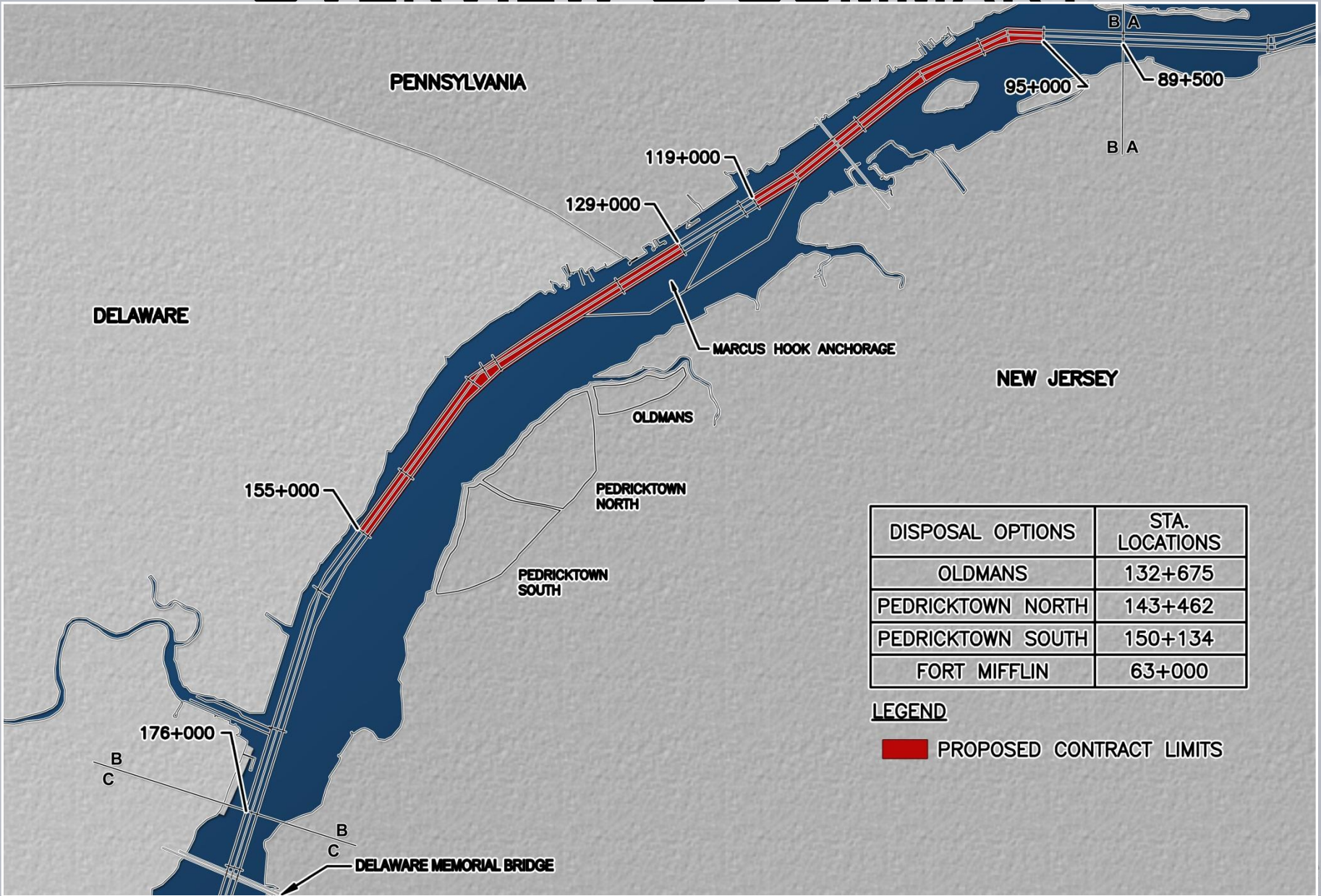
# DREDGING, TRANSPORT & PLACEMENT

- Contract Overview & Summary
- Anticipated Dredging Template
- Gross Quantities
- Acceptable Dredging Methods
- Placement Locations, Methods, & Restrictions





# OVERVIEW & SUMMARY



DISPOSAL OPTIONS	STA. LOCATIONS
OLDMANS	132+675
PEDRICKTOWN NORTH	143+462
PEDRICKTOWN SOUTH	150+134
FORT MIFFLIN	63+000

## LEGEND

 PROPOSED CONTRACT LIMITS



# CONTRACT DREDGING TEMPLATE



- Inconsistent Rock Surface
  - Metamorphic Rock
  - Weathered
  - Previous Drilling & Blasting (1940s)
- Development of Tailored Dredging Templates
  - Meet USACE Guidance
  - Reduce Surface Area & Required Grade





# CONTRACT DREDGING TEMPLATE



- Standard Deepening Template
  - Required Depth – 45 feet MLLW
  - 1 foot Pay Over-Depth (-46 feet MLLW)
  - 3H:1V Side Slopes
- Rock Template
  - Required Depth – 47 feet MLLW
  - No Pay Over-Depth
  - 1H:1V Side Slopes



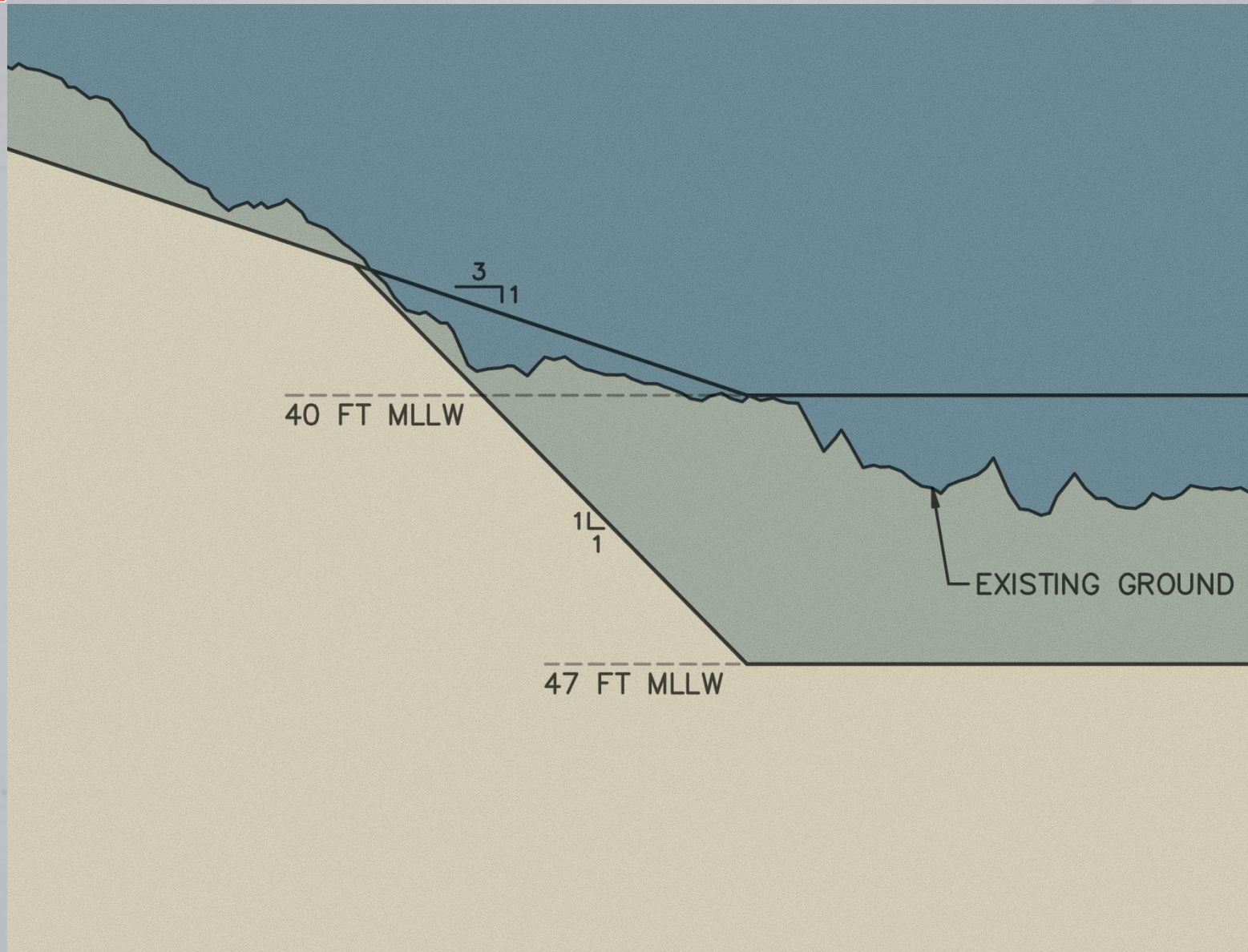
# TYPICAL SECTION – ROCK SLOPE



*Delaware River Main Channel Deepening Project*



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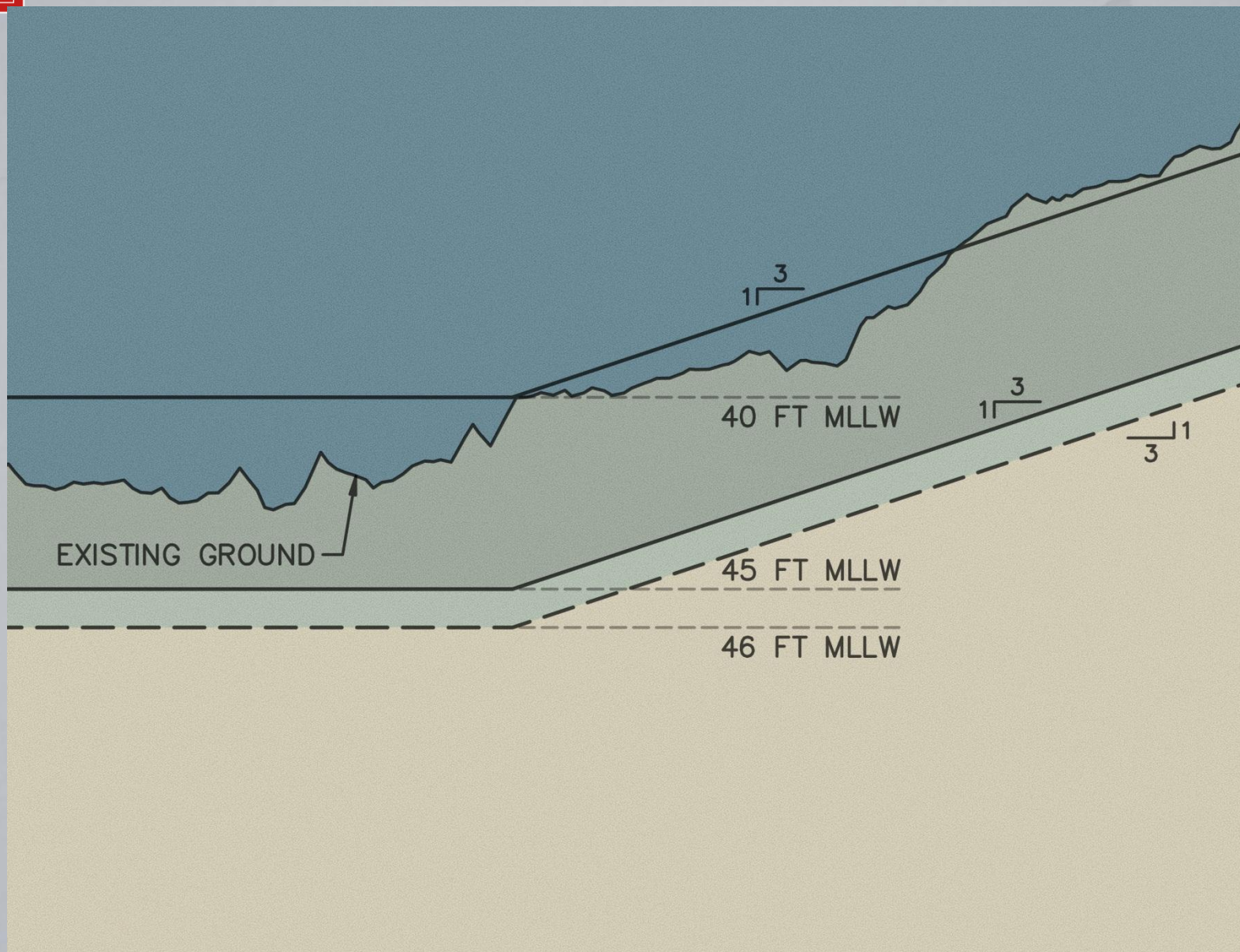
# TYPICAL SECTION – STANDARD SLOPE



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*Delaware River Main Channel Deepening Project*





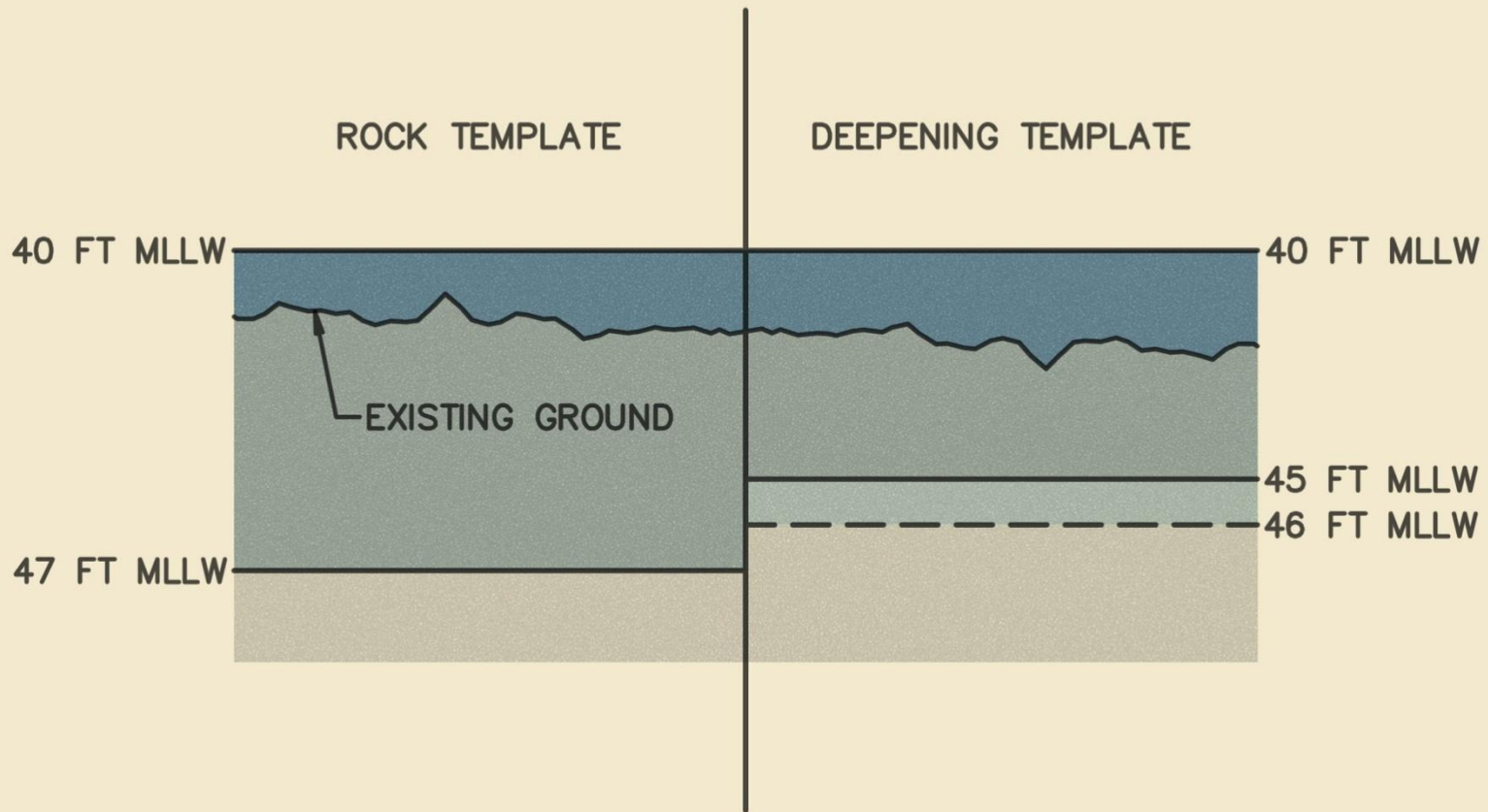
# TYPICAL SECTION – TEMPLATE INTERFACE



*Delaware River Main Channel Deepening Project*



# TYPICAL SECTION – TEMPLATE INTERFACE







# GROSS QUANTITIES

## (Rock & Non-Rock MATERIAL)

Stationing		Gross Quantities (from existing ground)		
<i>Start</i>	<i>End</i>	<i>to 45 ft MLLW</i>	<i>to 46 ft MLLW</i>	<i>to 47 ft MLLW</i>
95+000	119+000	313,951	644,509	1,094,452
129+000	155+000	238,344	476,060	787,631
<b>Totals</b>		<b>552,295</b>	<b>1,120,569</b>	<b>1,882,083</b>

*\*USACE 1996 Design Memorandum identified 229,000 cy of rock within the contract stationing (to 47 ft MLW).*

### **Notes:**

1. Contract pay quantities will vary from gross quantities presented based on contract dredging template
2. All quantities presented are calculated with 3H:1V Side Slope
3. Quantity computations based on USACE 2010 Multi-Beam Survey



# ACCEPTABLE DREDGING METHODS

- Mechanical Dredging (Clamshell, Excavator)
  - July 1<sup>st</sup> to March 15<sup>th</sup>
  - No Economic Loading (Overflow) of Scows

Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Mechanical Dredging											



# ACCEPTABLE DREDGING METHODS

- Hopper Dredging
  - July 1<sup>st</sup> to March 15<sup>th</sup>
  - No Economic Loading (Overflow)

Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
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**Mechanical Dredging**

**Hopper Dredging**



# ACCEPTABLE DREDGING METHODS

- Hydraulic Dredging
  - August 1<sup>st</sup> to March 15<sup>th</sup>
  - Direct Pump to USACE CDF (Oldmans,

Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
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**Mechanical Dredging**

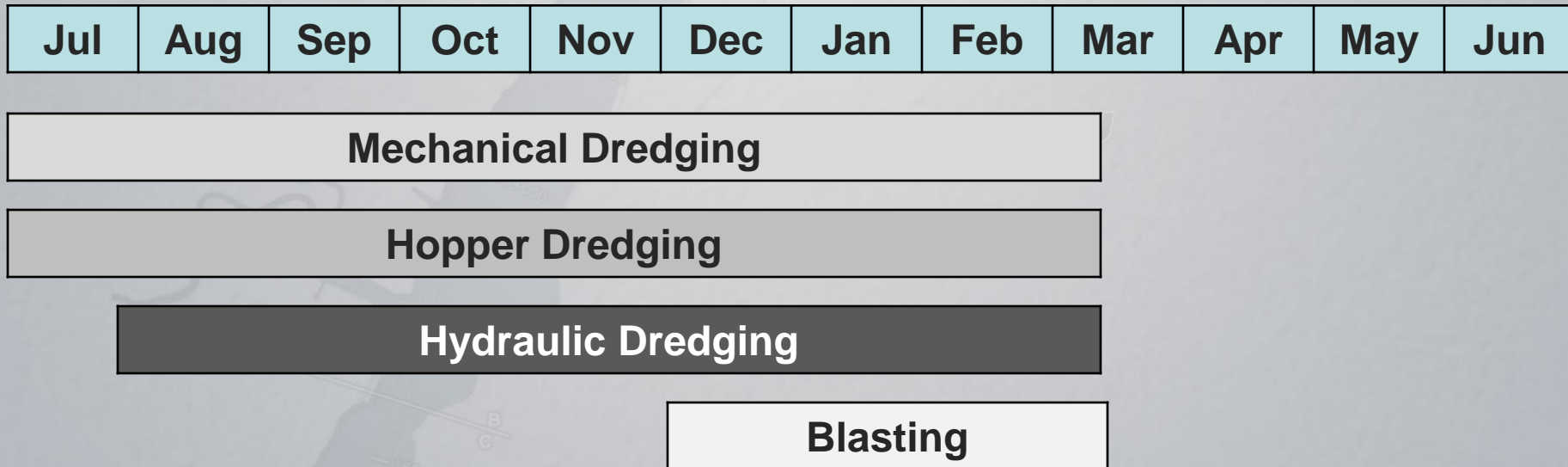
**Hopper Dredging**

**Hydraulic Dredging**

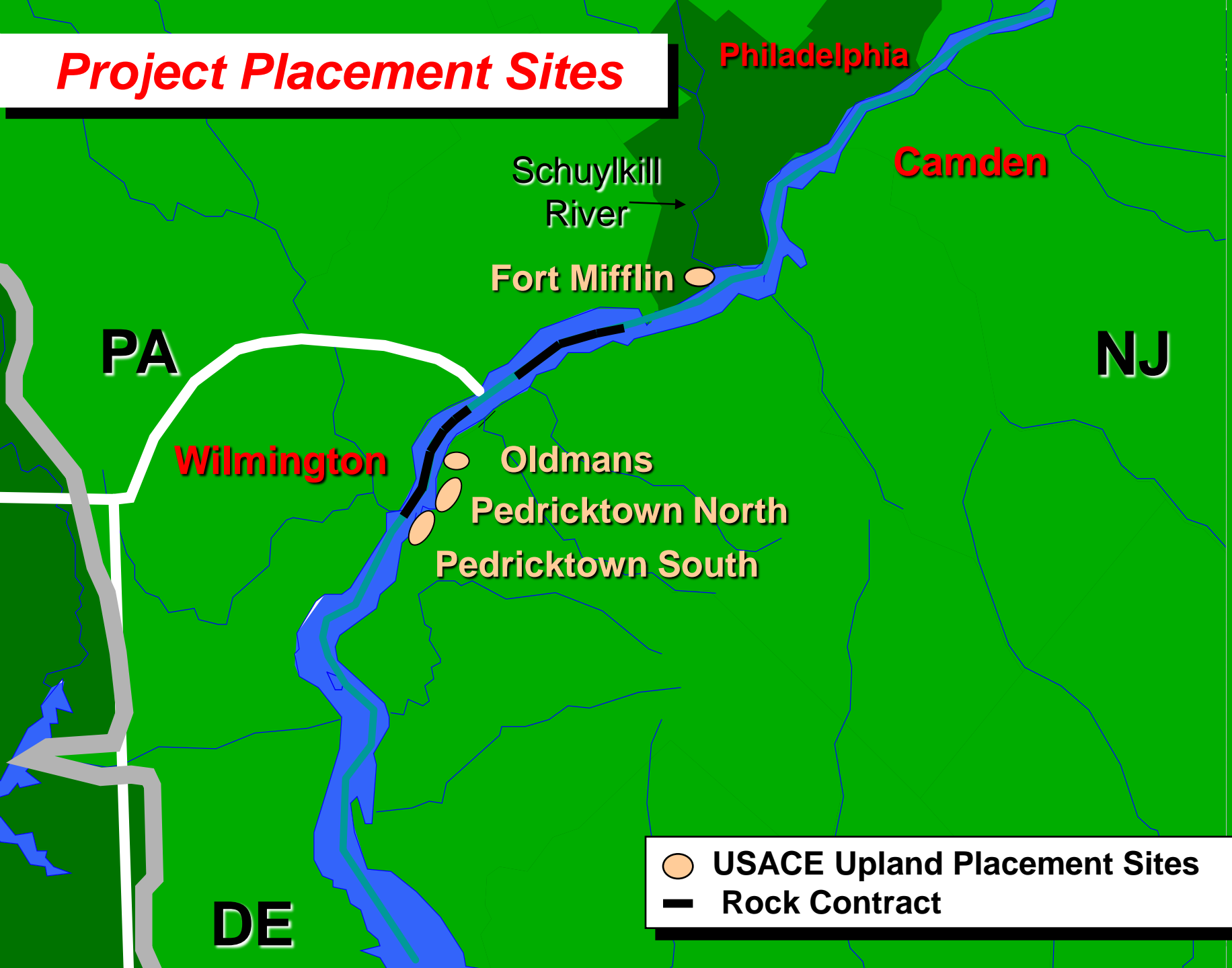


# ACCEPTABLE DREDGING METHODS

- Drilling & Blasting
  - December 1<sup>st</sup> to March 15<sup>th</sup>



# ***Project Placement Sites***







# PLACEMENT LOCATIONS

## - FORT MIFFLIN -









# Endangered Species Likely to be Present in the Construction Area

## Shortnose Sturgeon



## Atlantic Sturgeon





# Current Status

- ✓ The shortnose sturgeon is a Federally listed endangered species.
- ✓ The New York Bight population of Atlantic sturgeon which includes the Delaware River is currently proposed for Federal listing as an endangered species.
- ✓ It is likely that the Atlantic sturgeon will be a Federally listed endangered species prior to the start of construction.





# Endangered Species Act Consultation with the National Marine Fisheries Service for the Deepening Project

- ✓ NMFS issued a Biological Opinion for potential impacts to Federally listed species in the project area on July 17, 2009.
- ✓ The Biological Opinion provides monitoring requirements and a take statement for shortnose sturgeon.



# NMFS Take Statement

- ✓ The rock removal plan presented to NMFS showed construction over a two year period.
- ✓ The Biological Opinion allows the take of three shortnose sturgeon per winter due to blasting.
- ✓ The Biological Opinion allows the take of one shortnose sturgeon per winter due to mechanical dredging.
- ✓ If the take is higher than anticipated the Corps is required to reinitiate consultation with NMFS to identify additional measures to protect shortnose sturgeon, which could result in work delay.



- ✓ Because the Atlantic sturgeon is not currently a Federally listed species Endangered Species Act consultation with NMFS has not taken place.
- ✓ We are coordinating this issue with NMFS and if necessary a Biological Opinion will be in place prior to the start of construction.
- ✓ A Biological Opinion for Atlantic sturgeon would include a take statement and any additional monitoring requirements.



# Blasting Plan Presented to NMFS

- ✓ Use of controlled blasting methods such as delayed blasting, stemming of blast holes or surface charges to suppress the upward escape of blast pressure.
- ✓ Average peak pressure shall not exceed 70 psi at a distance of 140 feet.
- ✓ Maximum peak pressure shall not exceed 120 psi at a distance of 140 feet.
- ✓ Pressure will be monitored for each blast at a distance of 140 feet.





✓ Avoidance techniques will be utilized to drive fish from the blast area including scare charges.

✓ Monitoring of fish impacts after a blast.



# NMFS Blasting Plan Requirements

- ✓ Corps will submit a plan to NMFS outlining measures to insure that no shortnose sturgeon are present within 500 feet of the blast site.
- ✓ No blasting will occur when shortnose sturgeon are detected within 500 feet of the blast site.
- ✓ A plan has not yet been developed.



# NMFS Blasting Plan Requirements

- ✓ Acoustic measurement of the first three blasts is required to verify that blasting is less than or equal to Corps estimated values (i.e., peak 120 psi, average 70 psi at 140 feet, with noise levels below 180 dB at 500 feet).
- ✓ Monitoring for injured or dead shortnose sturgeon following a blast.
- ✓ Preparation of a final report summarizing the results of blasting and associated mechanical dredging and any takes of listed species (with input from Contractor).



# Shortnose Sturgeon Monitoring Requirements for Mechanical Dredging and Disposal of Material

- ✓ A NMFS approved endangered species observer must be present to observe all mechanical dredging and disposal activities to monitor for any capture of shortnose sturgeon.
- ✓ Qualifications of the proposed observer(s) must be submitted to NMFS for their approval.



# Equipment Requirements

- ✓ If dredging occurs at night or in poor lighting conditions, floodlights must be installed to allow for safe monitoring of the dredge bucket and scow for shortnose sturgeon or sturgeon parts.
- ✓ Sufficient time must be allotted between each scow load for inspection of the dredge bucket and scow for shortnose sturgeon or sturgeon parts.





# Observer Requirements

- ✓ An observer must be on board the dredge every day that mechanical dredging occurs.
- ✓ The observer must work a schedule that allows observation of 50% of scow loads.
- ✓ The observer shall observe the bucket as it comes out of the water and as the load is placed into the scow during each dredge cycle for evidence of shortnose sturgeon.



# Observer Requirements (Cont.)

- ✓ Any shortnose sturgeon observed in the dredge scow during mechanical dredging operations must be removed with a net and, if alive, returned to the river away from the work area.
- ✓ The observer will monitor disposal operations at the CDF to inspect for shortnose sturgeon or sturgeon parts that may have been missed when the load was deposited in the scow.
- ✓ After a scow is filled the observer will inspect the dredge bucket, and after a scow is emptied the observer will inspect the scow.



# Drilling and Blasting Restrictions

- Rock removal areas are situated in Delaware, New Jersey and Pennsylvania.
- Due to environmental and physical restrictions, blasting should be limited to those areas where other dredging methods are not feasible.
- Controlled blasting is required in all areas that require blasting.
- Each state has it's own regulations and requirements that must be fulfilled.



# State Regulators for Blasting

DELAWARE

OFFICE OF THE STATE FIRE MARSHAL

NEW CASTLE DELAWARE

302-323-5375

<http://statefiremarshal.delaware.gov>

NEW JERSEY DEPARTMENT OF LABOR AND WORKFORCE DEVELOPMENT

OFFICE OF PUBLIC SAFETY COMPLIANCE

TRENTON, NEW JERSEY

609-292-2096

<http://lwd.state.nj.us/labor>

PENNSYLVANIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

DISTRICT MINING OPERATIONS

POTTSVILLE DISTRICT OFFICE

570-621-3118

[www.depweb.state.pa.us](http://www.depweb.state.pa.us)

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# GENERAL REQUIREMENTS OF EACH STATE



- Licensing – the blaster has to be licensed or registered (permanent or temporary) by the State.
- Transportation Permit – Required by each state through which explosives or blasting agents are transported.
- Blasting Permit – Applications for permits with blasting plans must be filed and approved prior to any blasting activity.
- Monitoring:
  - Some states may require monitoring of the closest waterfront structure, or nearby structures that are of concern or of historical significance for seismic vibration.
  - USACE may also require seismic monitoring of adjacent waterfront structures.



# OTHER BLASTING CONCERNS

- Buried utilities including gas, petroleum and chemical product pipelines, communication cables and electric power lines cross the river and could be seriously damaged by blasting in the vicinity of the utilities. Blasting restrictions may have been established by the individual utility owners or operators.
- Storage tanks and underground storage chambers carved in the bedrock are present adjacent to some of the rock removal areas which may also have blasting restrictions imposed that must be followed.
- Blasting and monitoring reports shall be submitted to USACE daily.



# Alternatives to Blasting

- Contractors are encouraged to utilize rock removal techniques that will limit the amount of blasting required for this project.
- Core boring logs are available for review along with recovered rock core samples. Rock cores can be examined at Fort Mifflin.
- Suggestions are being solicited from contractors on methods that are available to facilitate the rock removal without blasting.



# GEOTECHNICAL DATA & REPORTS

- Summary of Data/Reports Completed to Date
- Potential Geotechnical Investigations/Surveys/Studies
- Comments, Questions, & Suggestions





# SUMMARY OF EXISTING GEOTECHNICAL DATA & REPORTS

- Non-Deepening Project Related Geotechnical Investigation
  - Vibracores
  - Test Pits
- Support for the 1996 USACE DRMCDP Design Memorandum
  - 1995 Geophysical Investigation
  - 1996 Rock Cores



# SUMMARY OF EXISTING GEOTECHNICAL DATA & REPORTS

- Investigations in Support for the Contract Plans & Specifications
  - 2009 Resistivity Survey
  - 2010 SPT Borings/Rock Cores
  - 2010 Vibracores



# VIBRACORES & TEST PITS (2/3)

- USACE Vibracores(1992) - EXMAR
  - Chemical Analysis of Sediments
    - Geotechnical Analysis Accompanied
  - EXMAR Vibracore
  - 6 Locations in Contract Footprint
  - Vibracore Logs & Grain Size Distribution
- USACE 1995 Vibracores — Alpine Ocean Seismic Survey, Inc.
  - Environmental Monitoring
  - Pneumatic Vibracore
  - 4 Locations in Contract Footprint
  - Vibracore Logs & Penetration Graphs



# VIBRACORES & TEST PITS (3/3)

- DRPA Vibracores (2005) – Aqua Survey, Inc
  - Sand Search
  - Rossfelder P-3 Vibracore
  - 2 Locations in Contract Template
  - Moisture Content & Grain Size Distribution
- USACE 2010 Vibracores- Aqua Survey, Inc
  - Investigate lower portion of Reach B
  - 10 locations in Contract Template
  - Vibracore Logs, Particle Size Distribution, Moisture Content, Specific Gravity, & Hydrometer





# 1995 GEOPHYSICAL INVESTIGATIONS

- Ocean Surveys, Inc.
- Geophysical investigation to locate top-of-rock underlying the riverbed along an approximate 28-mile stretch from Allegheny Avenue, Philadelphia, PA to Marcus Hook, PA
- Survey Stationing 0+000 to 152+000
- Completed in three (3) phases
  - Phase I – General Seismic Survey
  - Phase II – Targeted Seismic Survey
  - Phase III – Ground Penetrating Radar Survey



# PHASE I

- Performed in October, 1994
- Collected general hydrographic and seismic reflection data along three (3) longitudinal lines
  - Channel centerline and two (2) offsets between river stations 0+000 to 152+000
- Phase I Conclusions
  - Alternative methods of investigation needed where organic rich gaseous sediments inhibited seismic penetration
    - Mantua and Marcus Hook Anchorages
  - Generalized locations of Top-of-Rock above 50 ft MLLW to guide Phase II
  - Proposed Phase III Ground Penetrating Radar (GPR) in gaseous sediment areas.



# PHASE II

- Performed in February, 1995
- Collected detailed hydrographic and seismic reflection data in areas where Phase 1 data indicated top-of-rock may be present above -50' MLLW
  - Approximately 30% of channel length surveyed in Phase I was identified for detailed Phase II seismic reflection mapping
- Areas of investigation
  - Site A - Sta 7+500 to Sta 16+000
  - Site B - Sta 96+000 to Sta 120+000
  - Site C - Sta 131+000 to Sta 135+000  
Sta 137+000 to Sta 144+000
- Provided contouring based on seismic survey data interpretation



# PHASE III

- Performed in April, 1995
- To account for organic rich gaseous sediment during Phase I investigations, a Ground Penetrating Radar (GPR) survey was performed
- Investigations were done in the channel adjacent to the BP and Sun Oil terminals in Marcus Hook, PA. (Sta. 120+000 to 131+000)
  - Primarily the Advanced Maintenance section of Reach B's annual maintenance dredging
- Used grab samples and seismic data to correlate GPR data to sediment





# 1996 ROCK CORES

- USACE Rock Cores (1996) — Warren George, Inc.
  - Investigate proposed rock areas identified in the geophysical investigation
  - 33 Locations in Contract Footprint
  - Designations: CB-254 to CB-286
    - Two (2) were not drilled (Existing elevation below -47')
  - Truck-mounted rig on a spud barge
    - 1-7/8" Diamond Bit Size
  - Drilling Logs
  - Laboratory Analysis: Unit Weight, Pulse Velocity & Unconfined Compressive Strength



# 2009 RESISTIVITY SURVEY

- Geophysical investigation of Delaware River
  - Stationing identified to possibly contain rock within the dredging template (Sta. 95+000 to 120+000 & Sta. 126+500 to 141+500)
- Contractor – DEMCO NV of Belgium through URS
- Survey performed in March 2009
- Resistivity Data Collection (Ohm-m)
  - Nine (9) profile survey lines performed
  - Bottom towed multichannel cable
  - Penetration depths of up to 10 m
- Utilized a portion of the 1996 Rock Cores to Correlate Resistivity Data to Channel Conditions



# 2010 SPT BORINGS & ROCK CORINGS (1/3)

- USACE Study (2010) — Uni-Tech Drilling Co.
  - Investigate proposed rock cut areas, Sta. 96+000 to 121+000 & 129+000 to 141+000
  - 22 Locations in Contract Footprint
  - Designations: CB-287 to CB-308
  - CME-750 Truck Mounted Drill Rig on the
  - R/V Hayes — Jack-up Barge



# 2010 SPT BORINGS & ROCK CORINGS (2/3)

- SPT sampling obtained using 3-inch diameter split barrel sampler driven with 300 lb hammer allowed to fall 30 – inches (ASTM D3550)
- Note: N-Values represented not standard in accordance with ASTM D1586
  - 3 inch O.D split barrel sampler and 300-lb hammer vs. 2 inch O.D. samples and 140-lb hammer
- Sampling stopped when at least 50 blows were recorded at less than 2” penetration (i.e. 50/2”)
- Rock Coring was then implemented if the boring refusal elevation was above 47 ft MLLW



# 2010 SPT BORINGS & ROCK CORINGS (3/3)

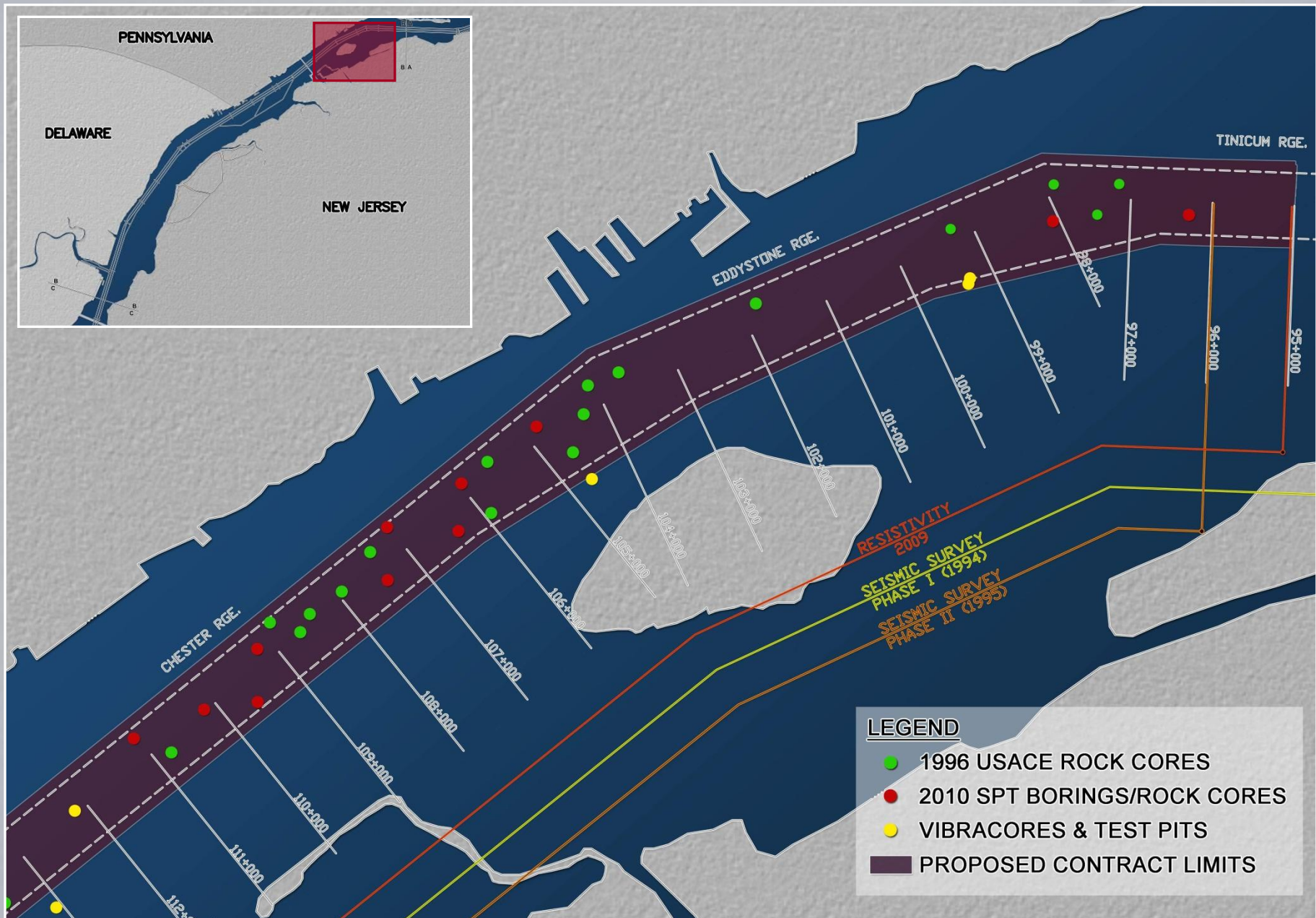
- Resulting Data:
  - SPT Boring & Drilling Logs, Rock Quality Designation (RQD), Rock Mass Rating (RMR)
  - Laboratory Analysis : Particle Size Distribution, Atterberg Limits, Moisture Content, Unconfined Compressive Strength, Point Load Index/Est. Compressive Strength, Splitting Tensile Strength



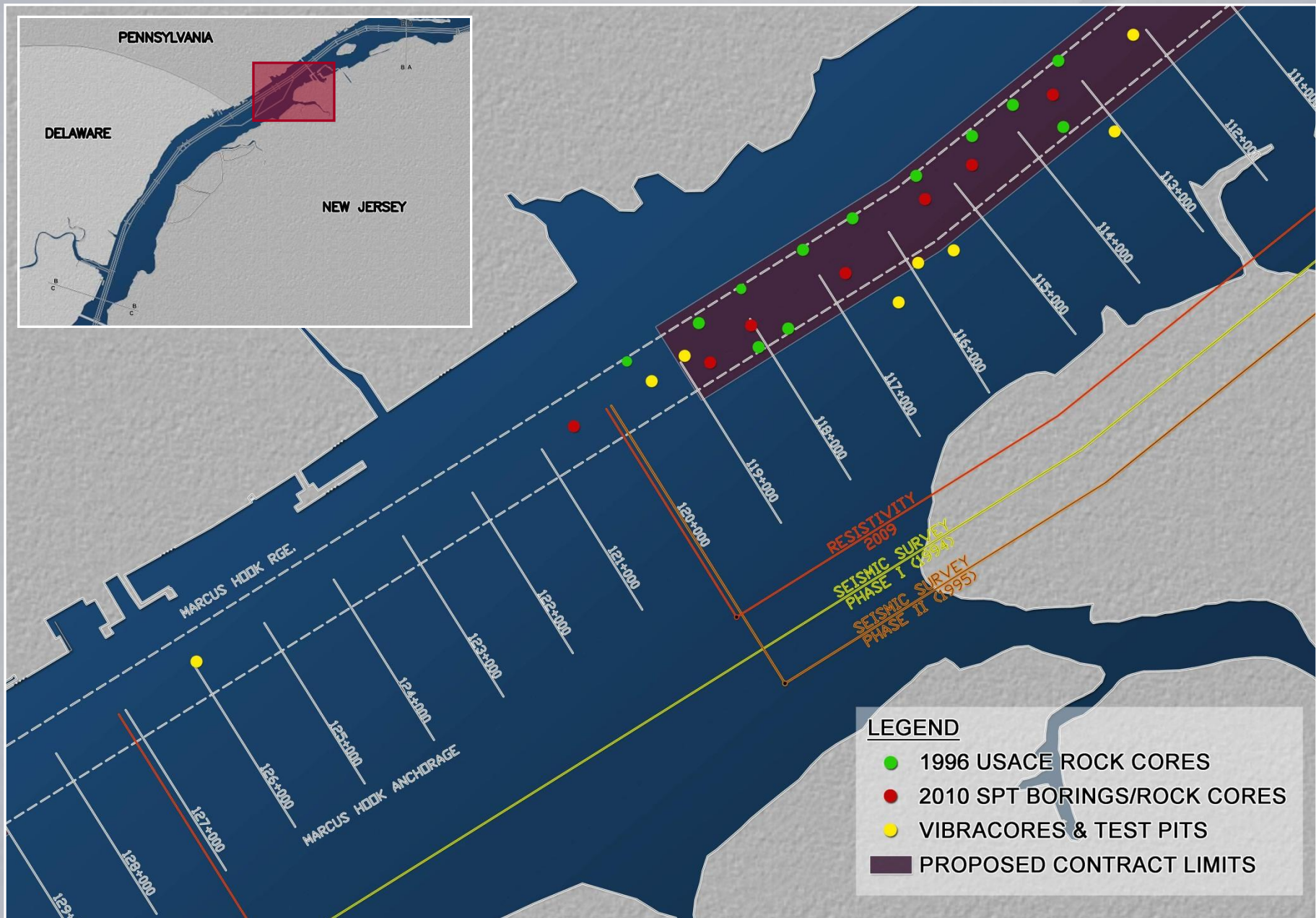


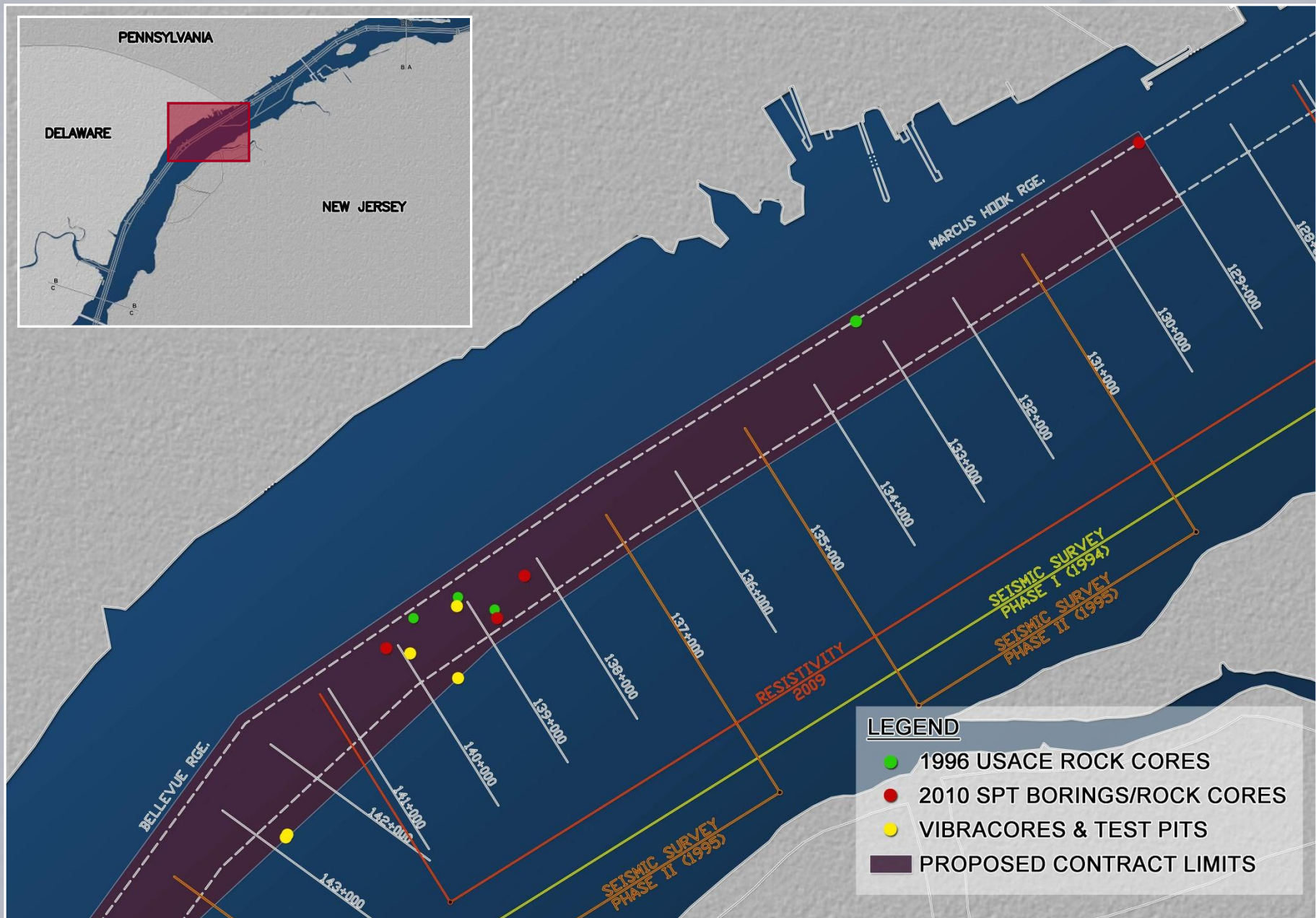
# OTHER AVAILABLE DATA

- Side-Scan Sonar Survey
  - Currently these reports are not readily available for distribution.
  - Appointments to view at CENAP Office can be made through Charles Sutphen
- Rock Cores (Available until March 4<sup>th</sup>, 2011)
  - All existing Rock Cores available for viewing today at Fort Mifflin
  - Scheduling a time to view the cores
    - Contact Mike Hart (215-656-6513) or Charles Sutphen (215-656-6697)

















# POTENTIAL GEOTECHNICAL INVESTIGATIONS

- Resistivity Survey
  - Station 141+000 to 155+000
- SPT Boring/Rock Coring
- Industry Recommendations & Suggestions will be accepted and reviewed

Contact:

Charles Sutphen

[Charles.F.Sutphen@usace.army.mil](mailto:Charles.F.Sutphen@usace.army.mil)

(215) 656-6697

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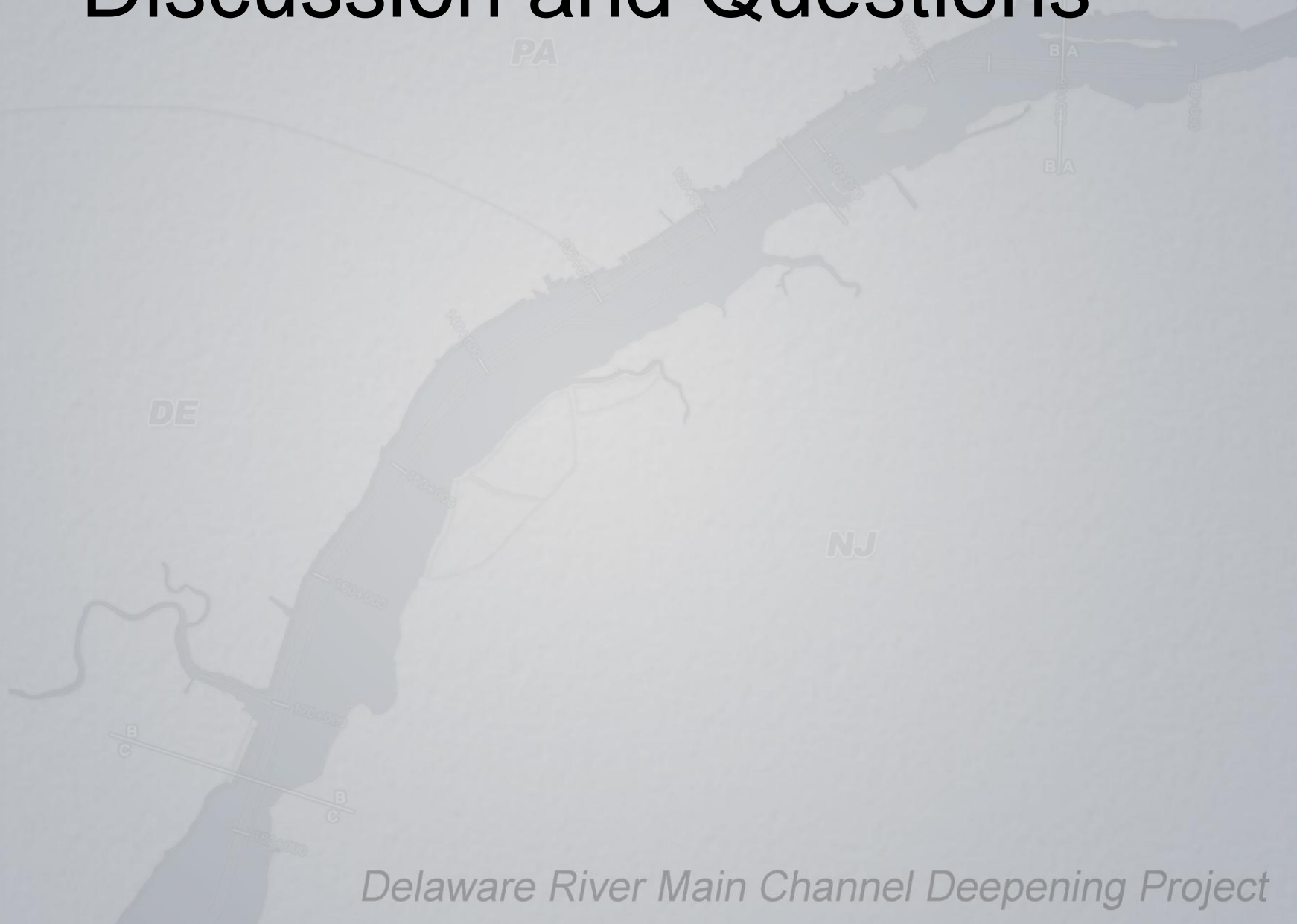


# Contract Types

- Three main contract styles are being evaluated:
  - Fixed Low Bid
  - Competitive Negotiated Procurement – Best Value
  - 2 Step Design Process



# Discussion and Questions



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